

FIG. 1

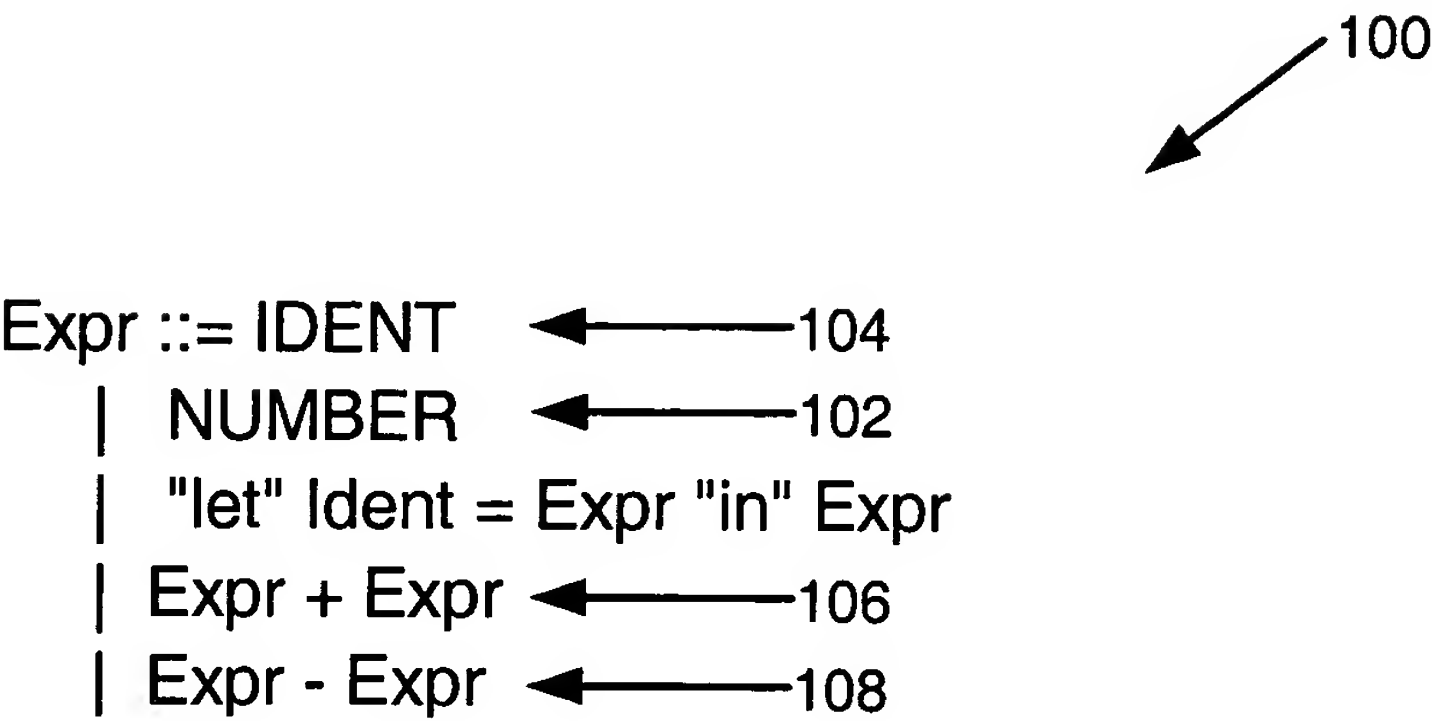


FIG. 2

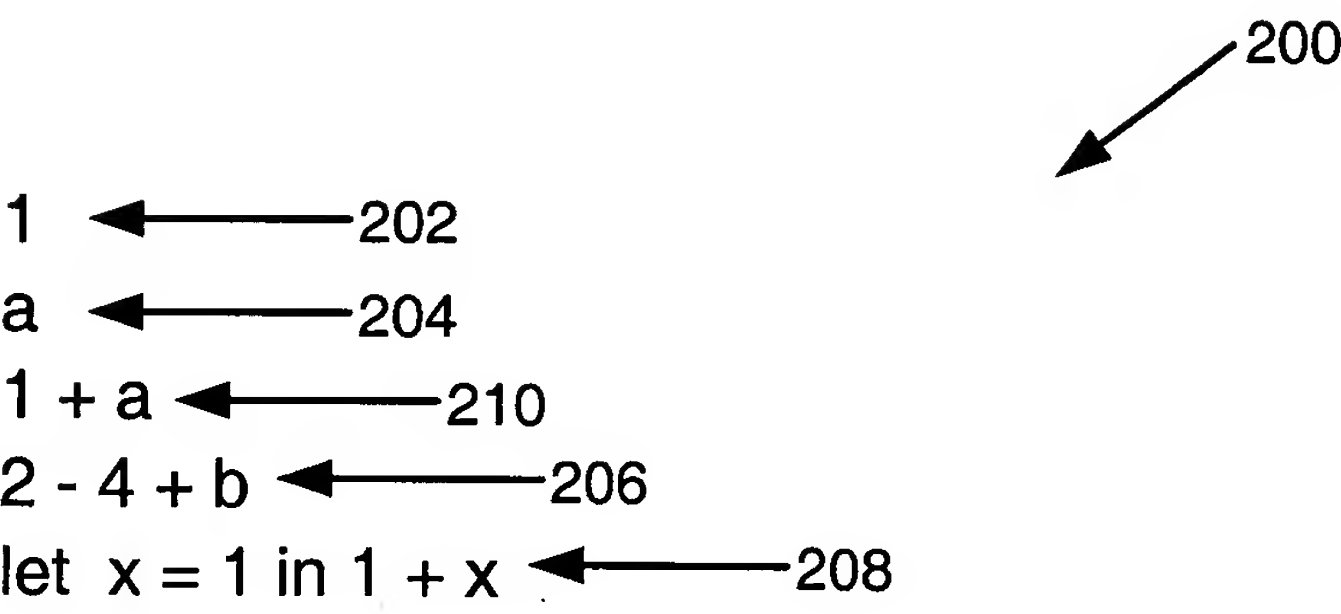
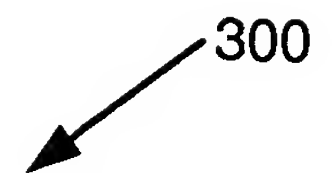


FIG. 3

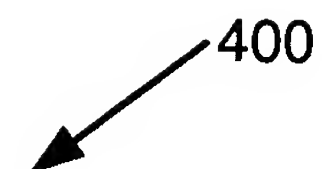


```
abstract structure Exp ← 314
  case Const ← 306
    val as Integer
  case Bin ← 308
    op as Op
    left as Exp ← 302
    right as Exp ← 304
  case Let ← 310
    name as Name
    def as Exp
    body as Exp
  case Var
    name as Name

enum Op
  Add
  Sub

type Name = String
```

FIG. 4



```
structure Exp
  public override ToString() as String?
  match me
    x as Const:
      return ToString(x.val)
    x as Bin:
      return "(" + x.left + ToString(x.op) + x.right + ")"
    x as Let:
      return "(let " + x.name + "=" + x.def + " in " + x.body +
      ")"
    x as Var:
      return x.name

ToString(o as Op) as String?
  match o
    Add: return "+"
    Sub: return "-"
```

FIG. 5

500

Closed(e as Exp) as Boolean
return Closed(e, {}) ← 510

type BoundedNames = Set of Name ← 512
Closed(e as Exp, ns as BoundedNames) as Boolean
match e ← 502

Const(_): return true ← 504

Bin(_ , l, r): return Closed(l, ns) and Closed(r, ns) ← 518

Let(n, d, b): return Closed(d, ns) and Closed(b, ns + {n}) ← 514

Var(n): return n in ns ← 506

508

516

FIG. 6

600

Eval(e as Exp) as Integer
require Closed(e, {})
return Eval(e, {->})

type Environment = Map of Name to Integer
Eval(e as Exp, env as Environment) as Integer
require Closed(e, Indices(env))
match e

Const(v): return v

Bin(o, l, r): return Eval(o, Eval(l, env), Eval(r, env))

Let(n, d, b): return Eval(b, env + {n -> Eval(d, env)})

Var(n): return env(n)

Eval(o as Op, l as Integer, r as Integer) as Integer
match o

Add: return l + r

Sub: return l - r

FIG. 7

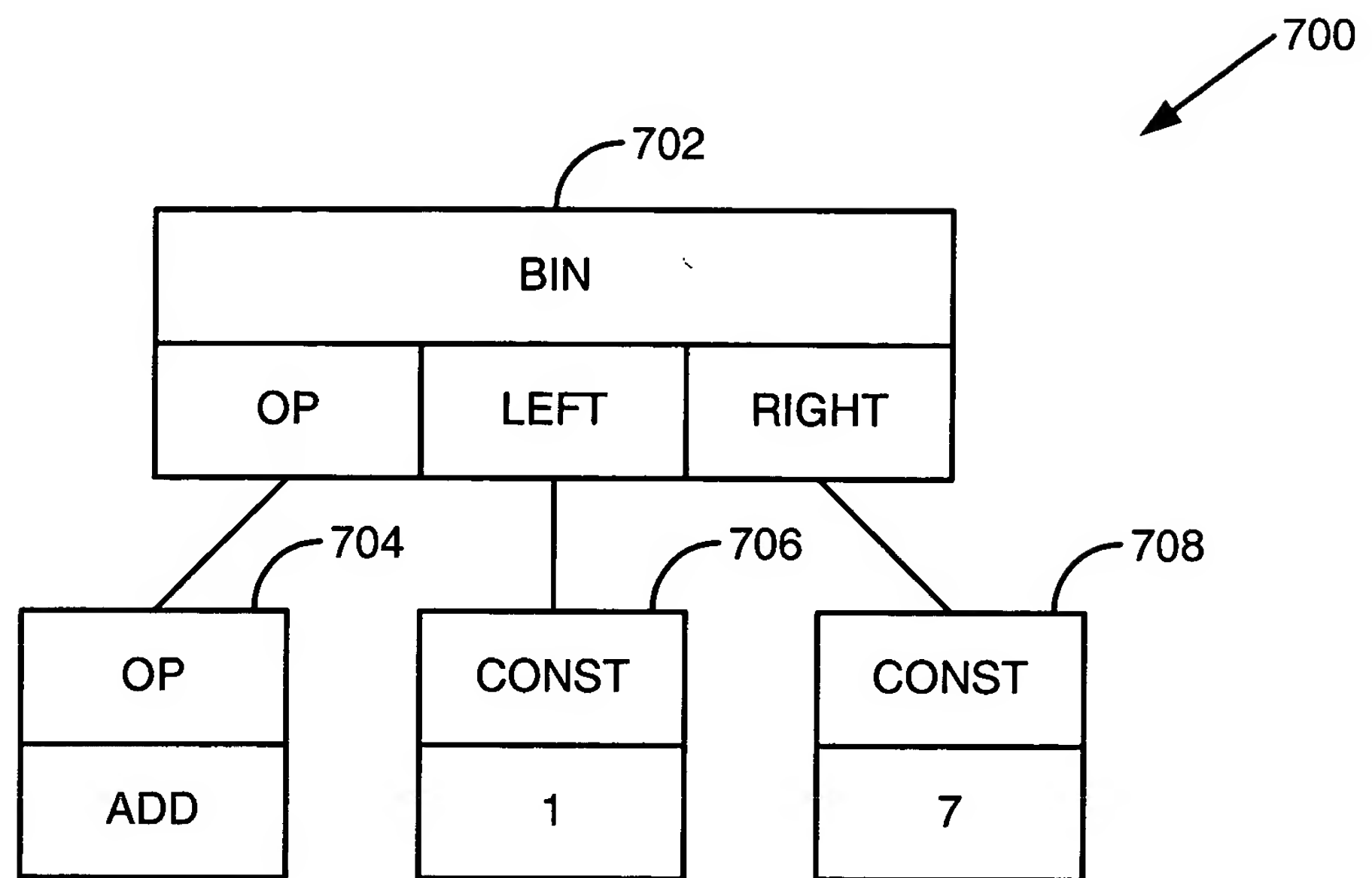


FIG. 8

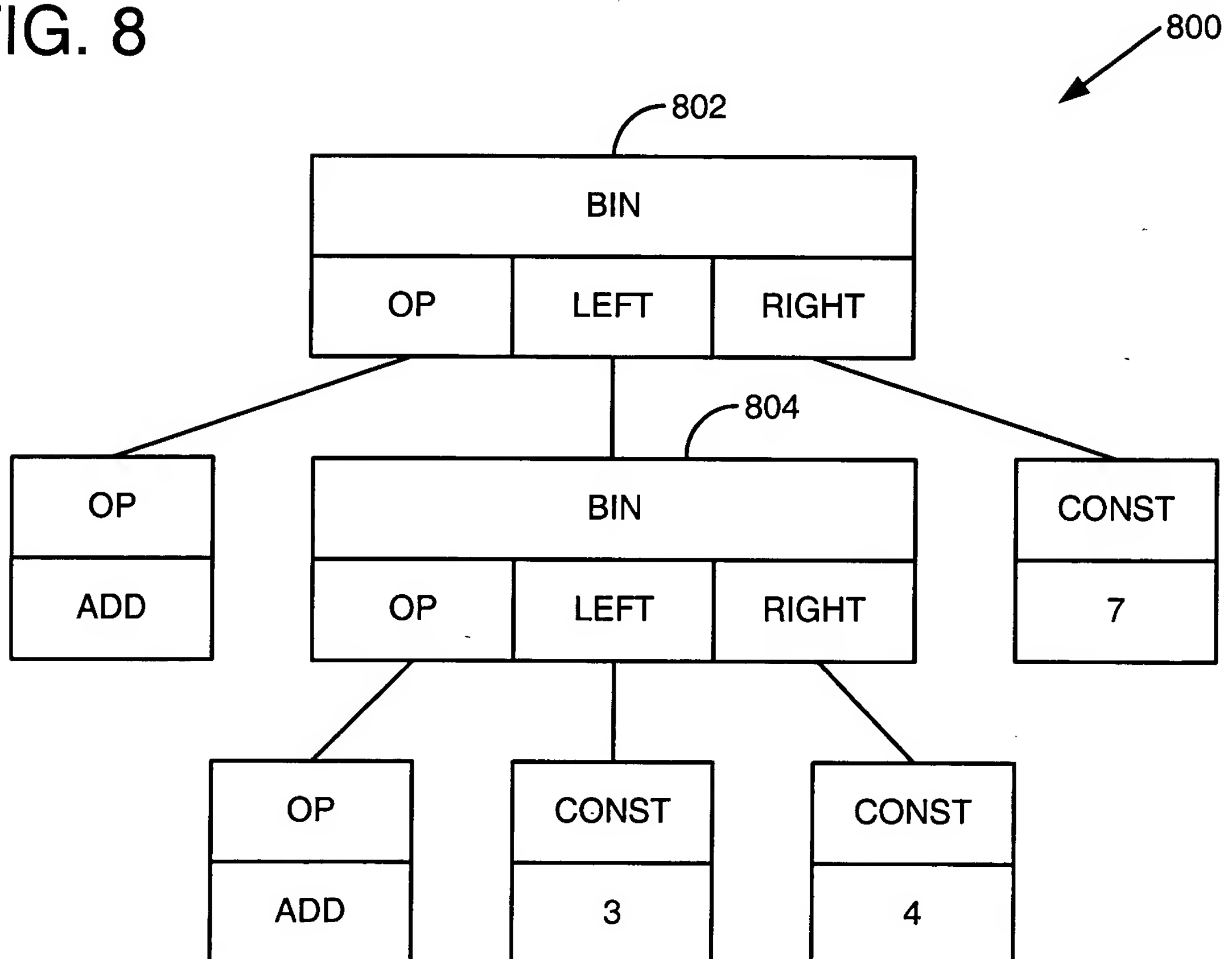


FIG. 9

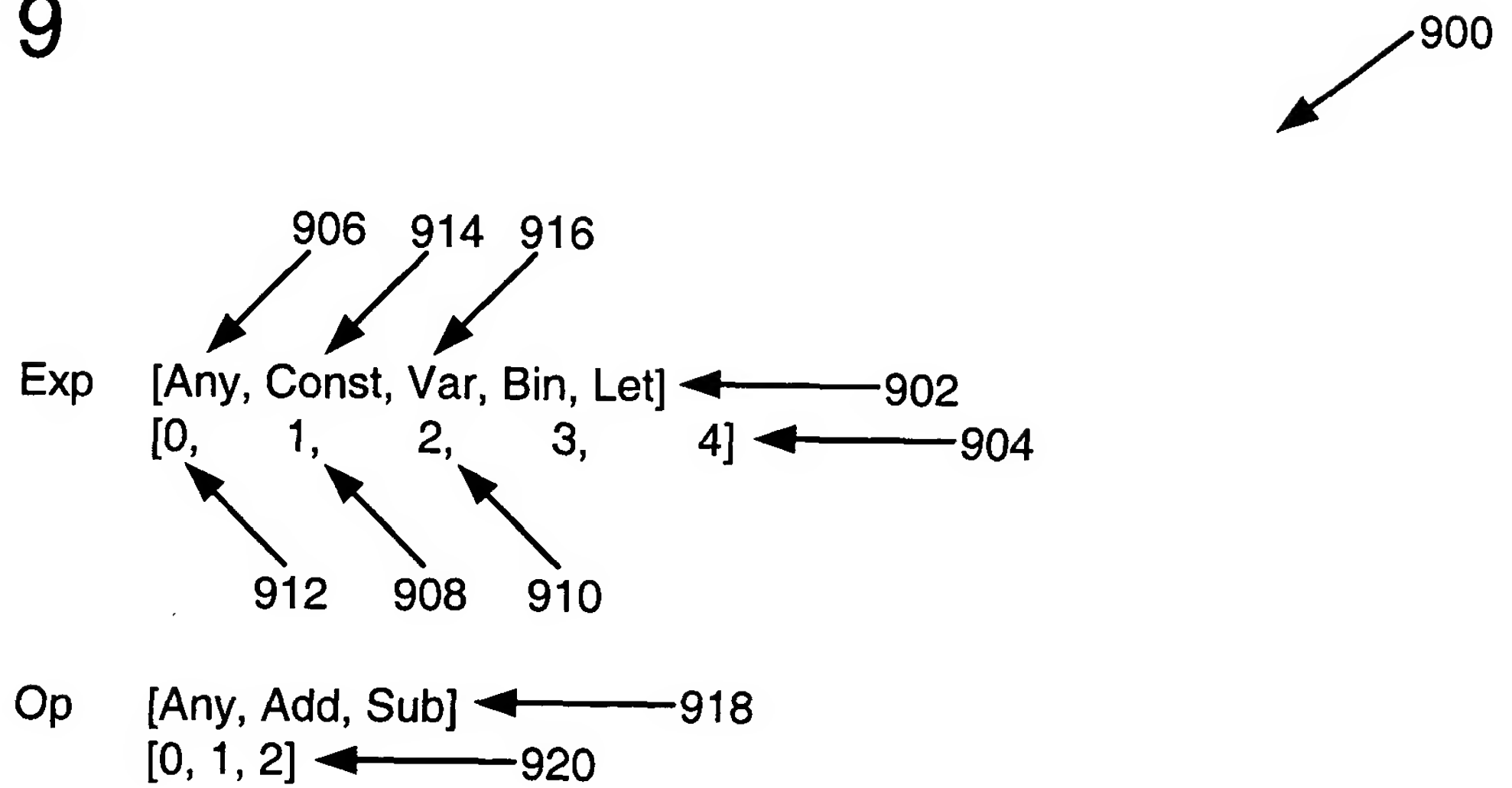


FIG. 12

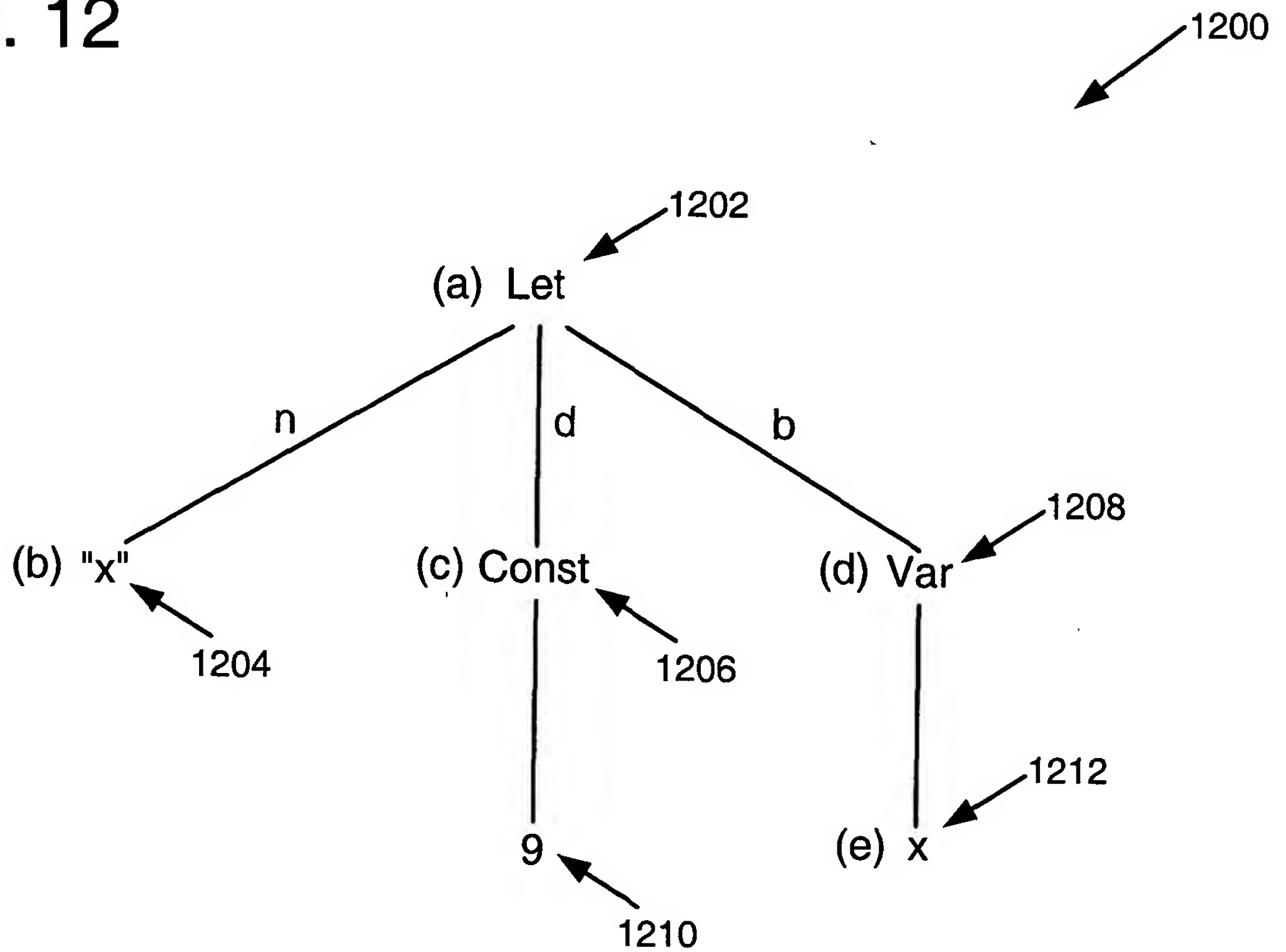


FIG. 10

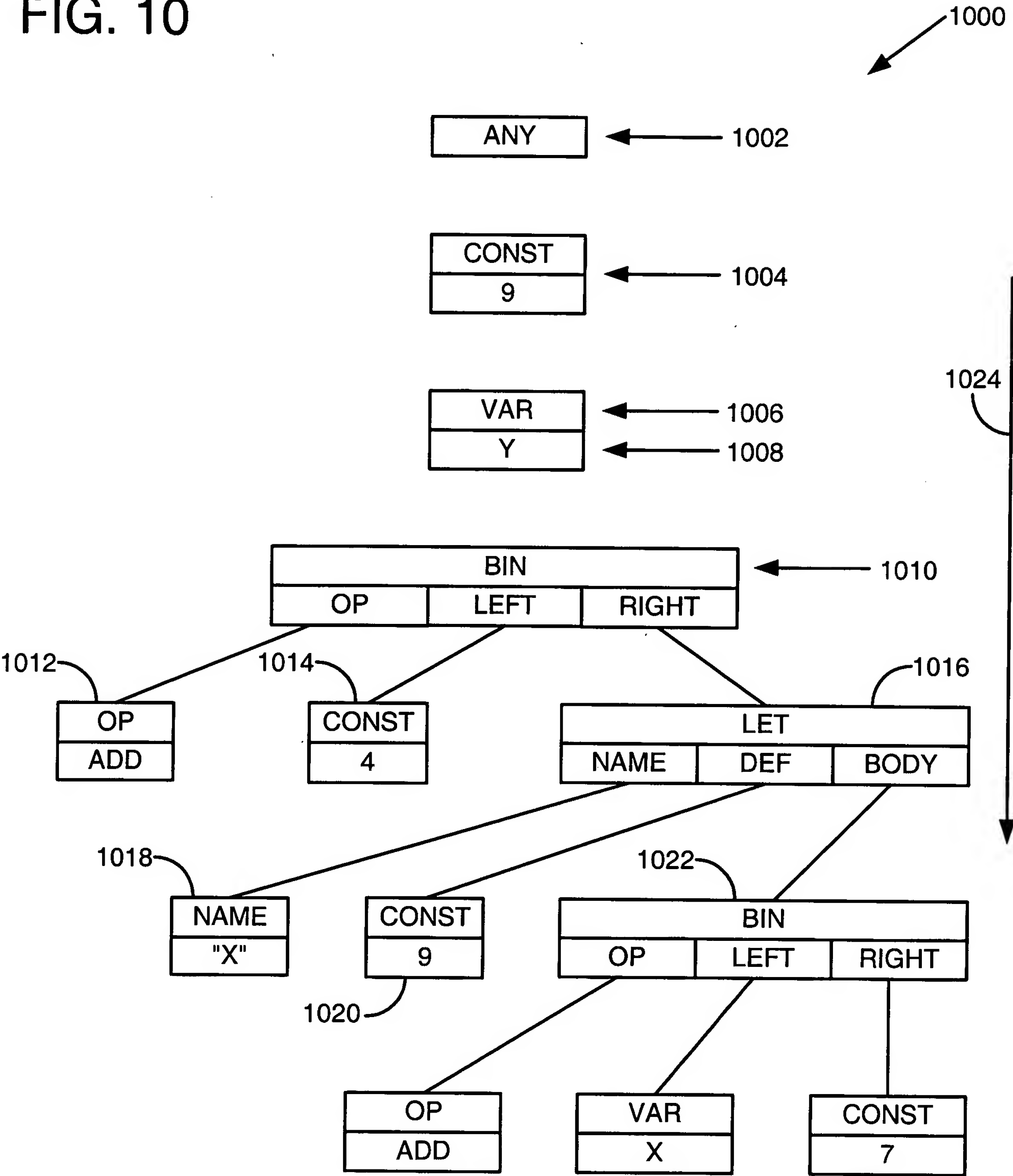


FIG. 11

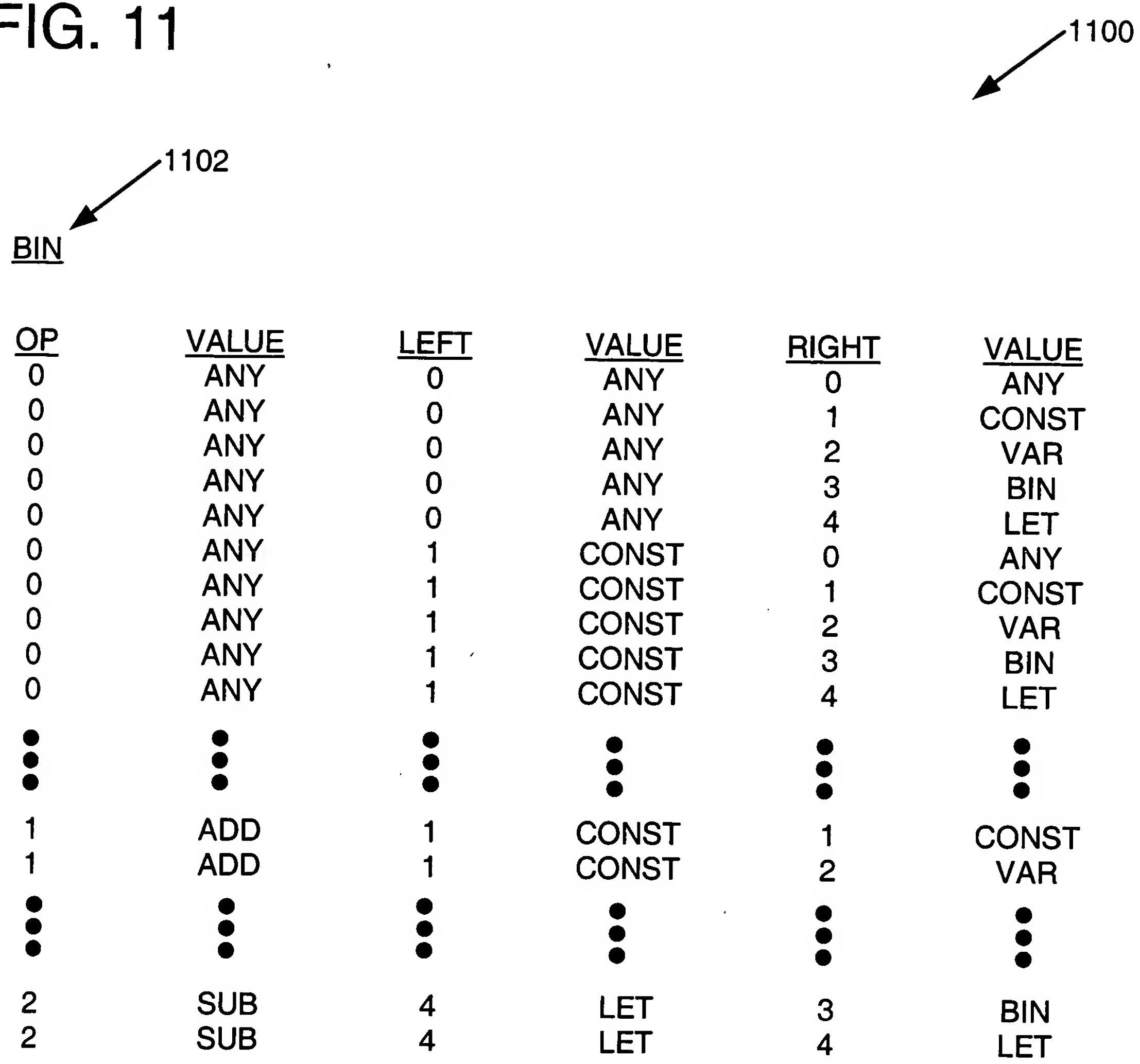


FIG. 13

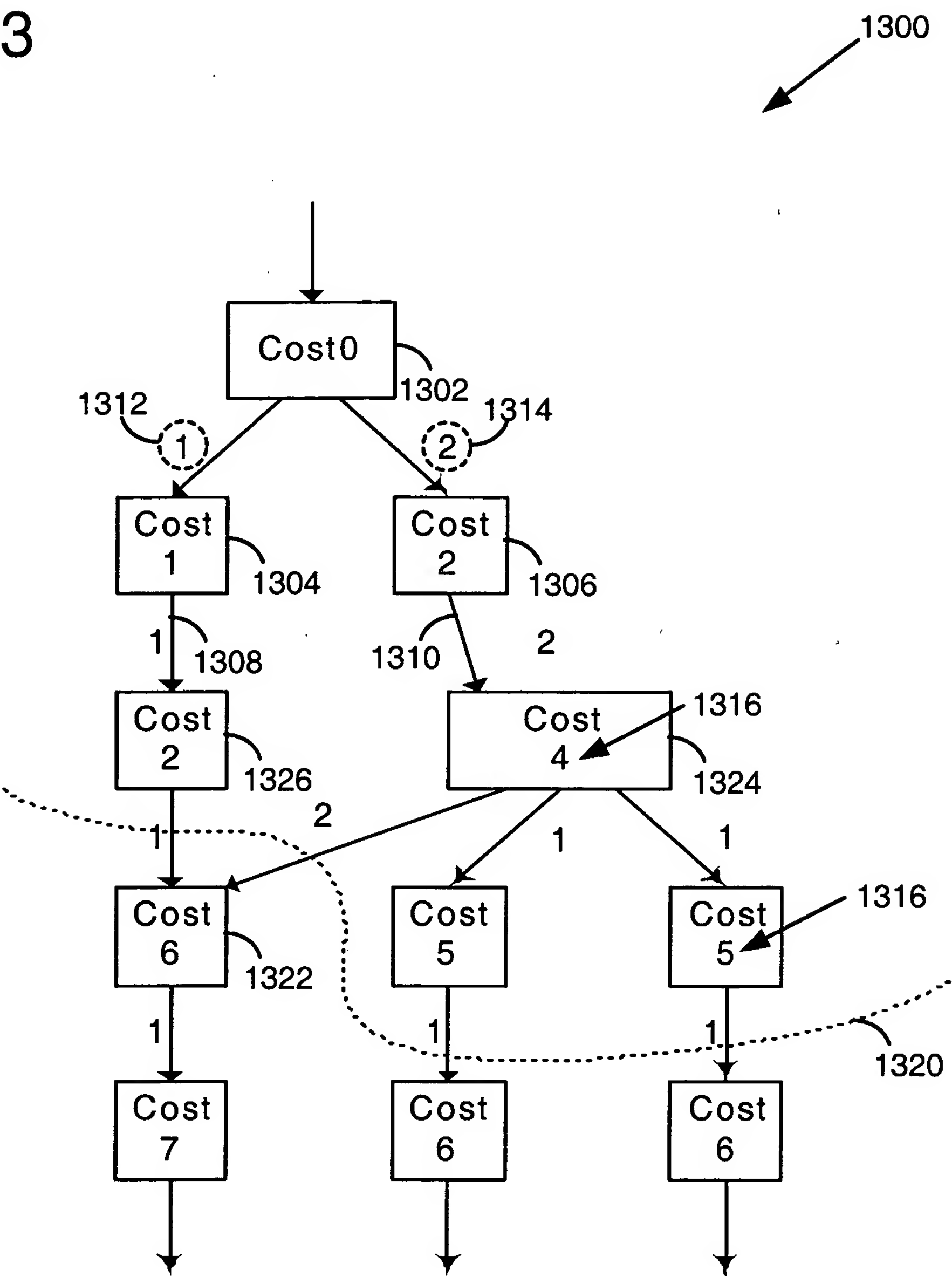


FIG. 14

1400

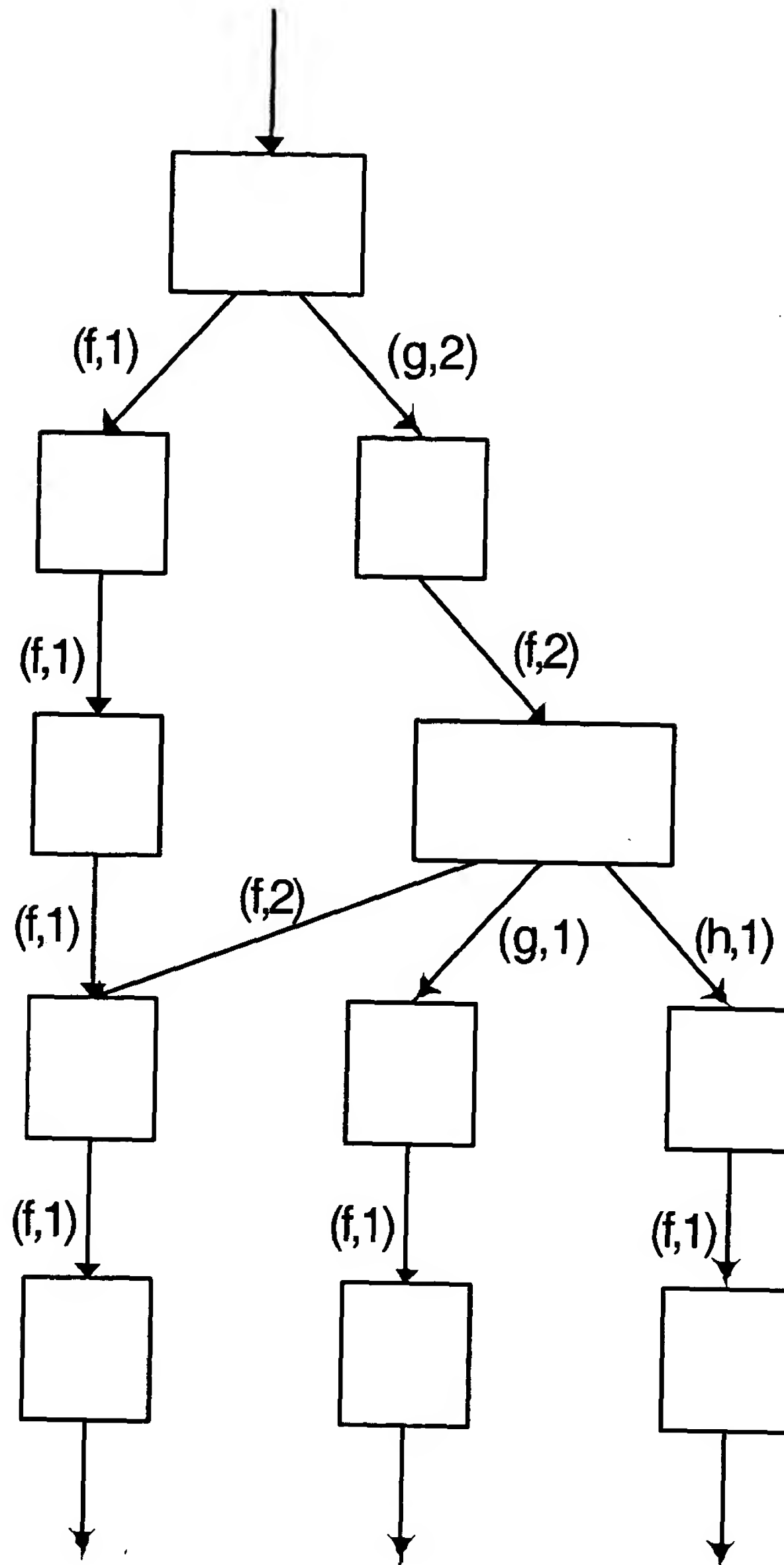


FIG. 15

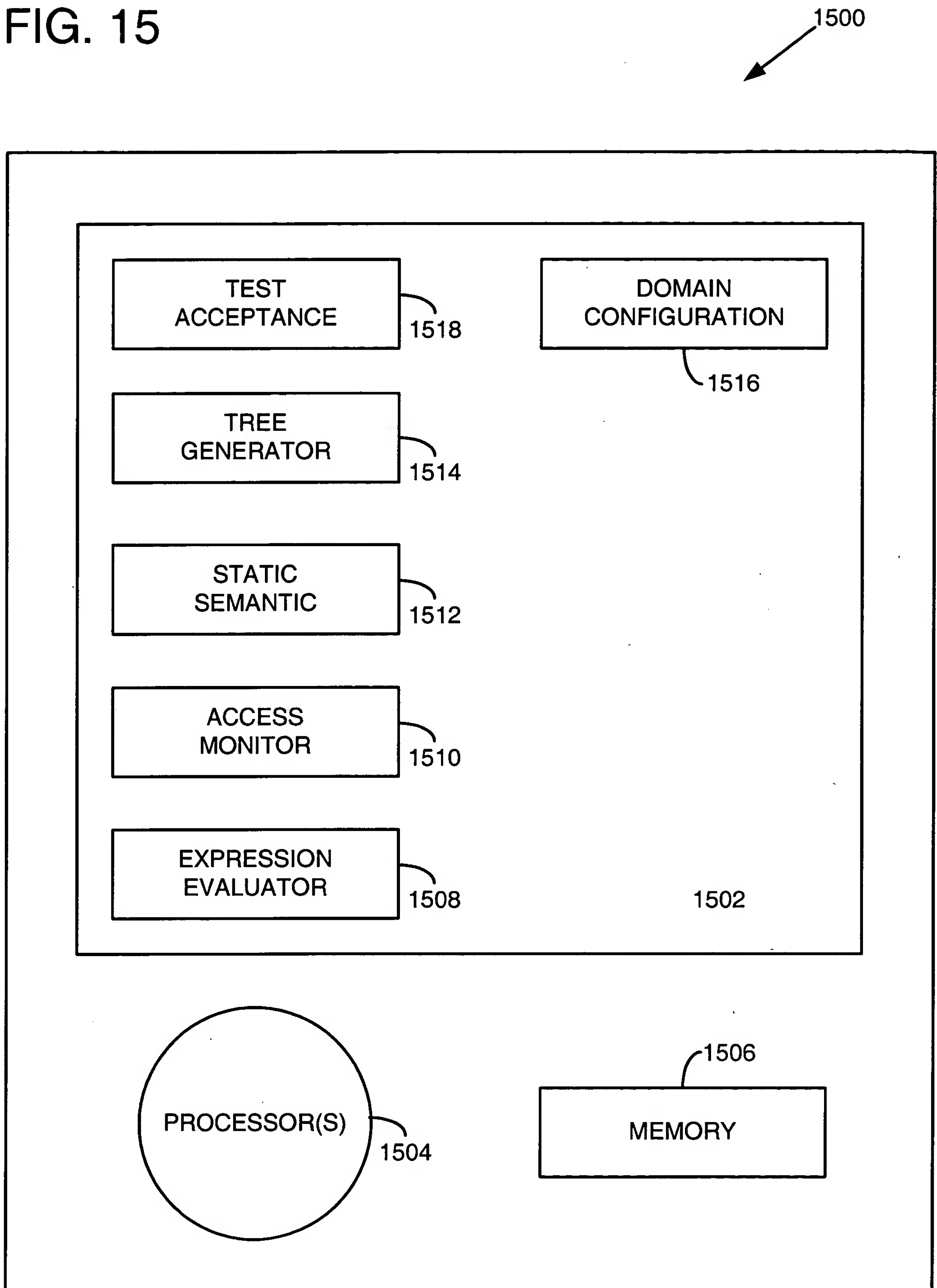


FIG. 16

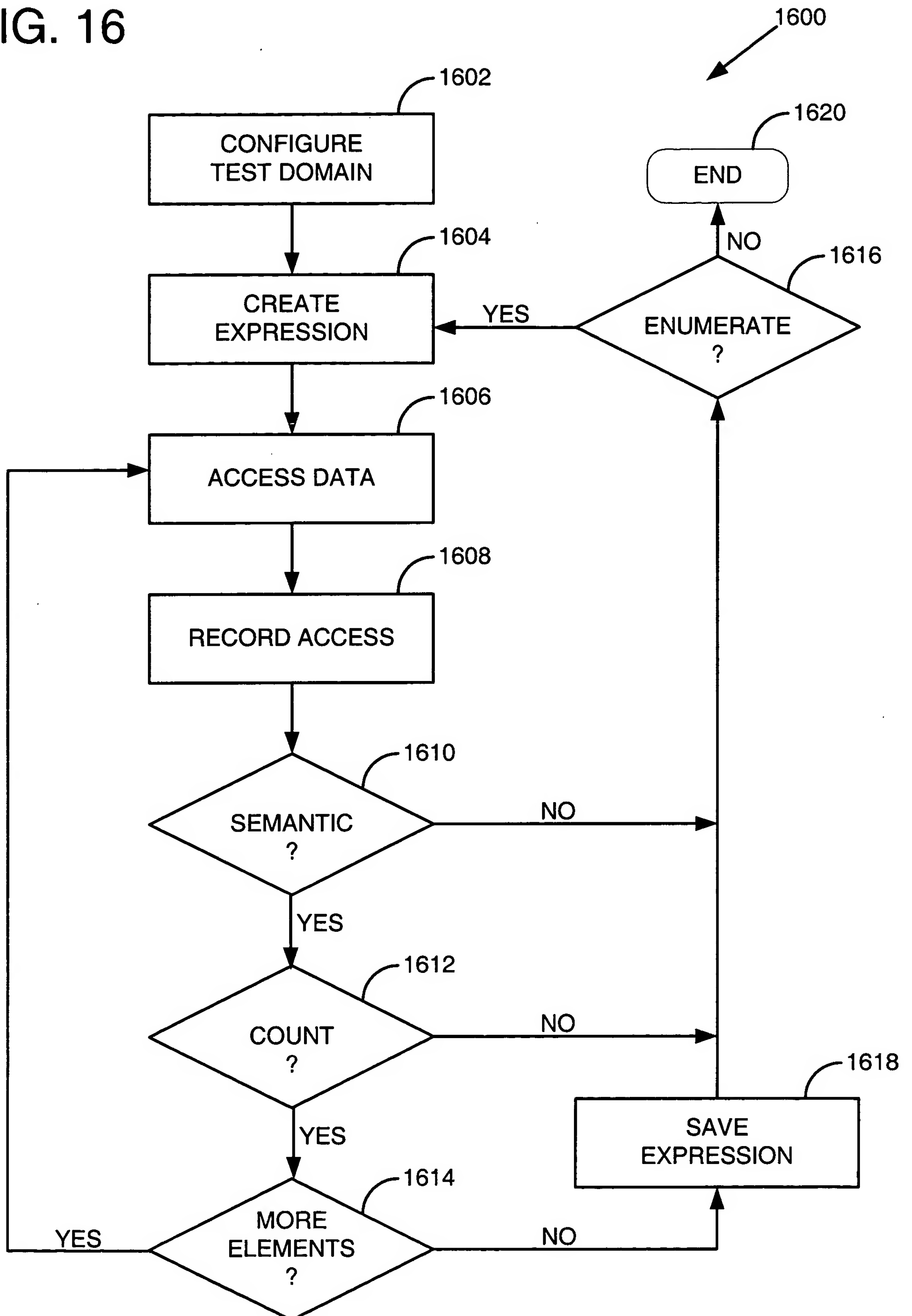


FIG. 17

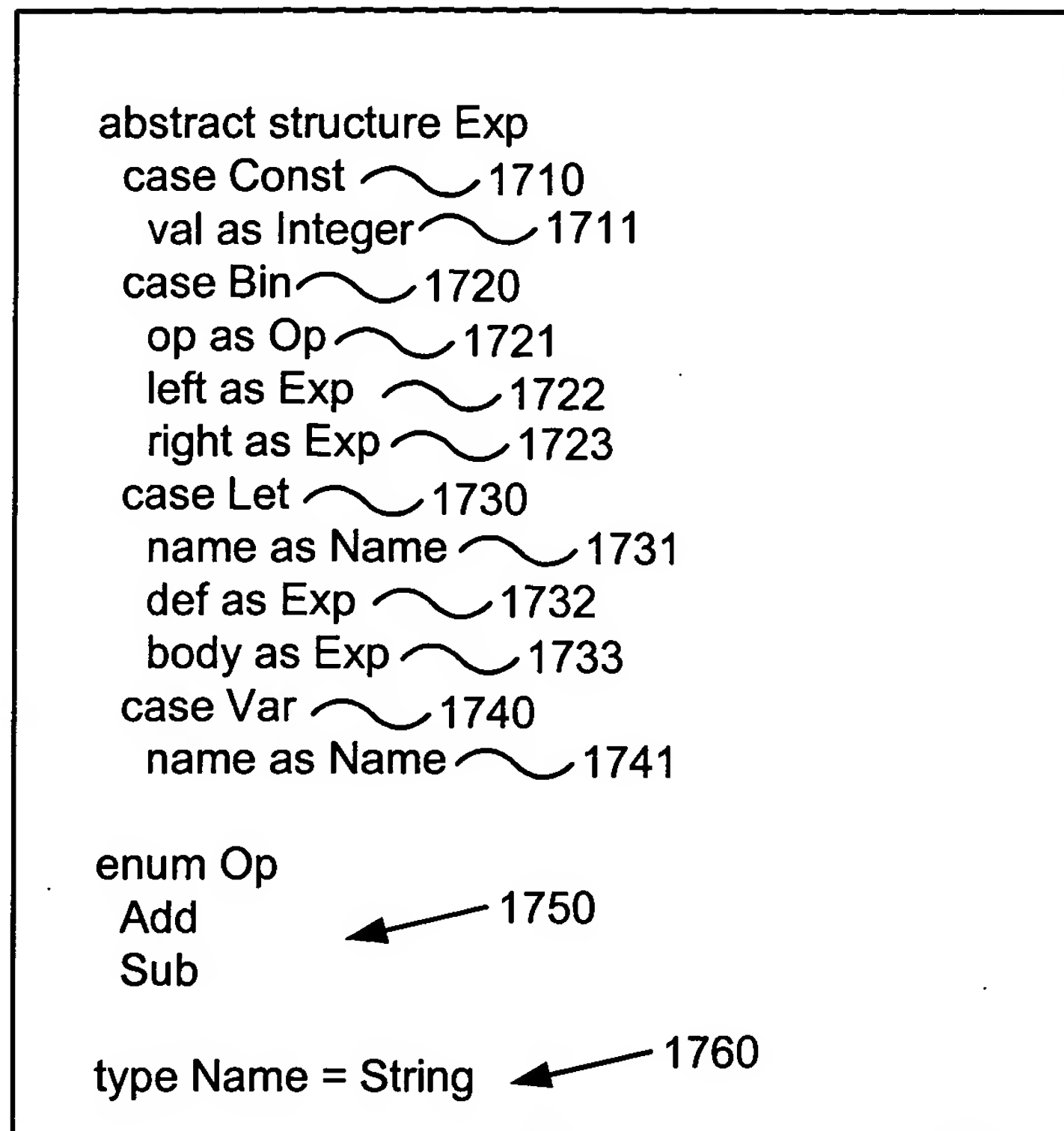


FIG. 18

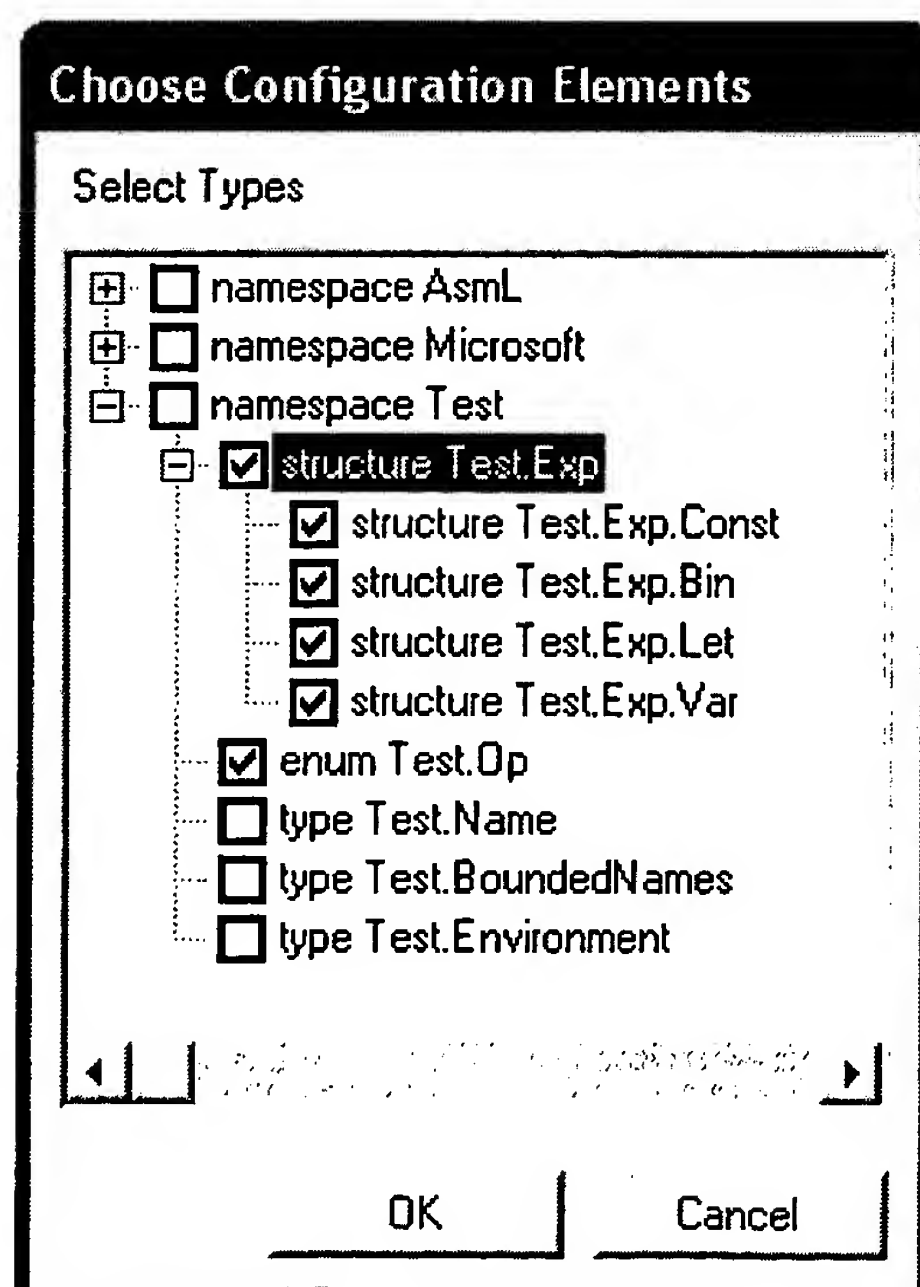


FIG. 19

1900

1910

Edit Domain for structure Test.Exp.Bin

Defined 1921

☐ Use Definition 1924

☐ Evaluate Dynamically

Inherited 1922

☐ Use Type

Selected Types

Available Types

Up Down

Generated 1920

☒ Use Generator 1930

MaxCount 1

1940

OK Cancel

FIG. 20

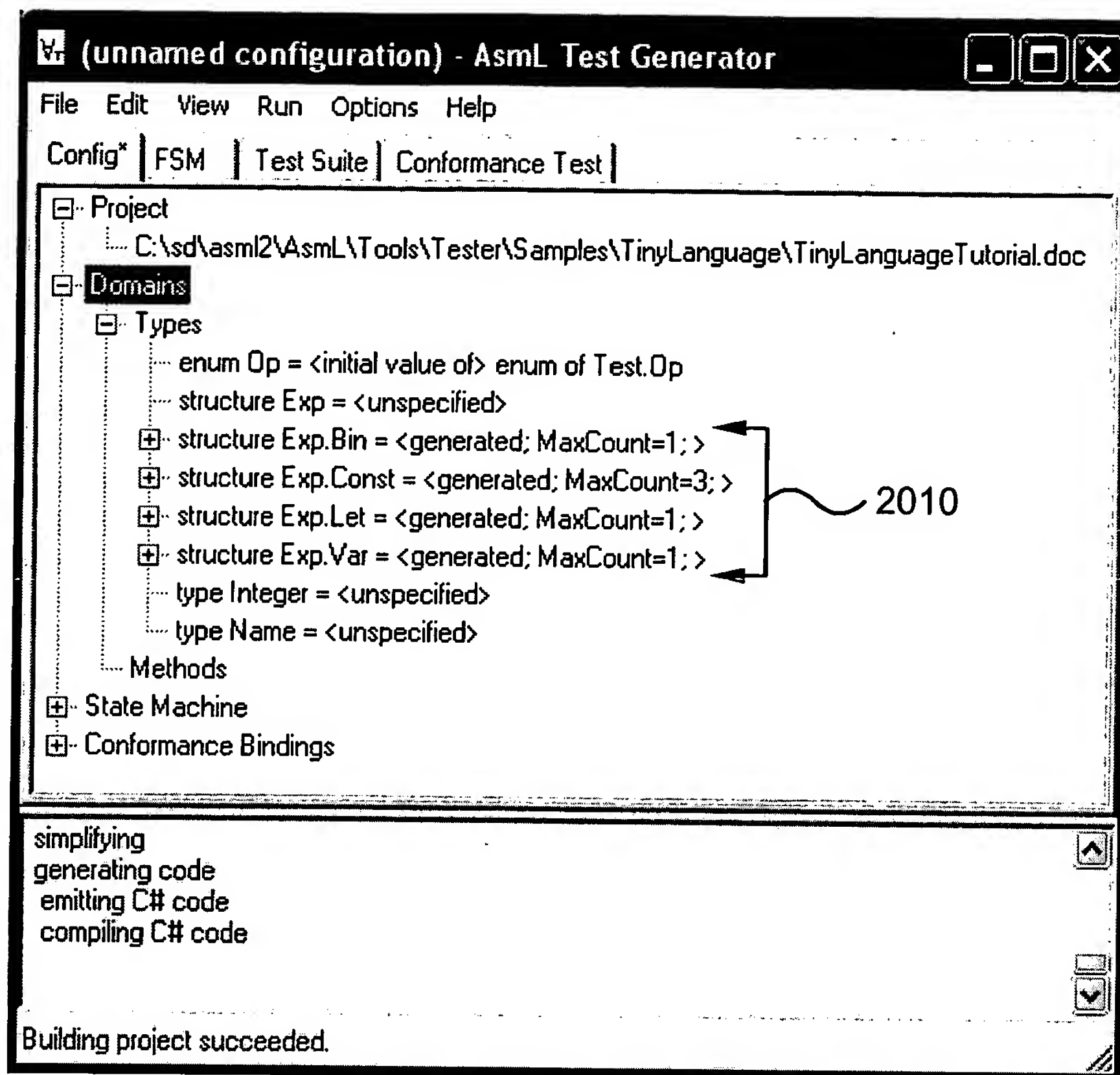


FIG. 21

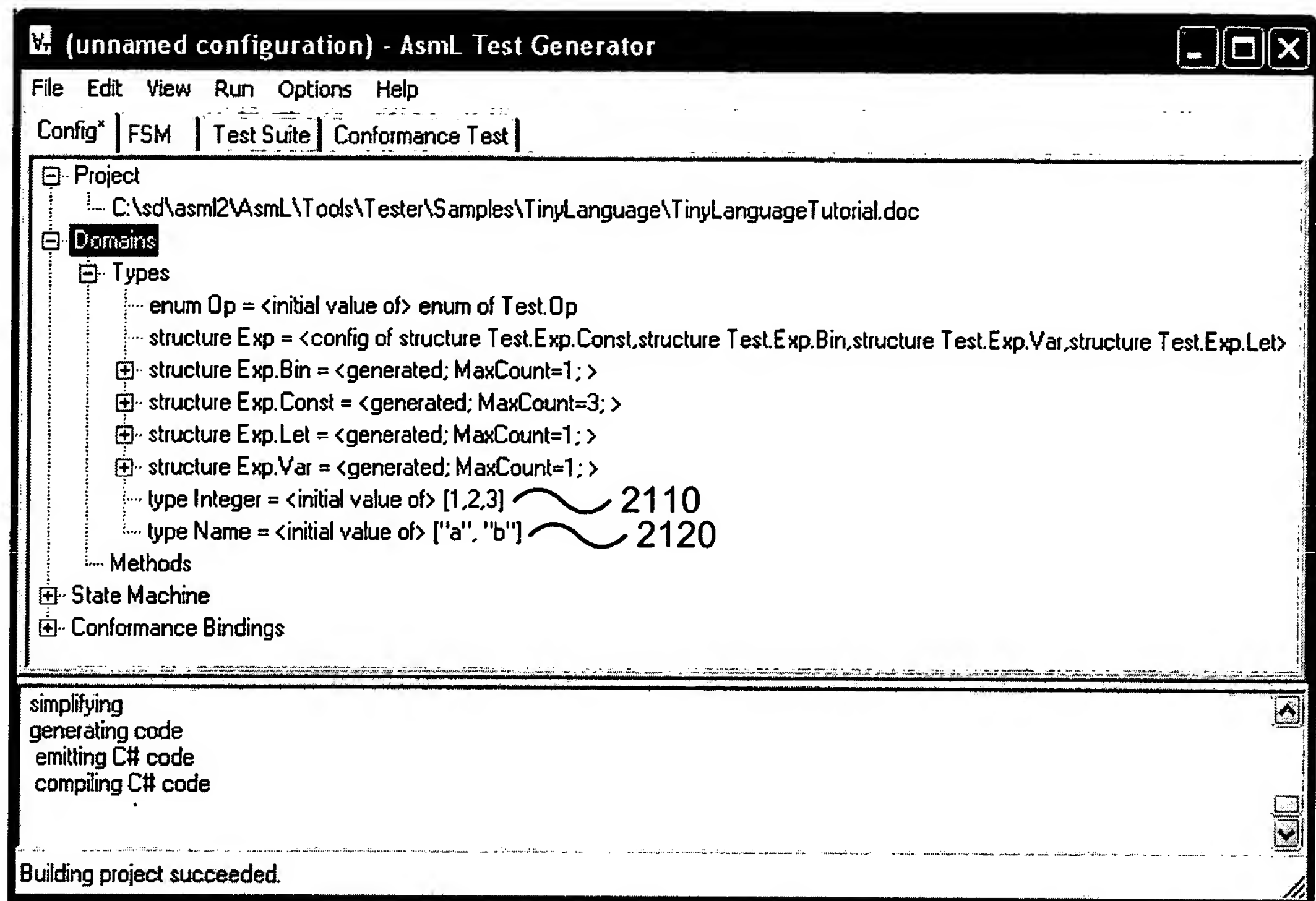


FIG. 22

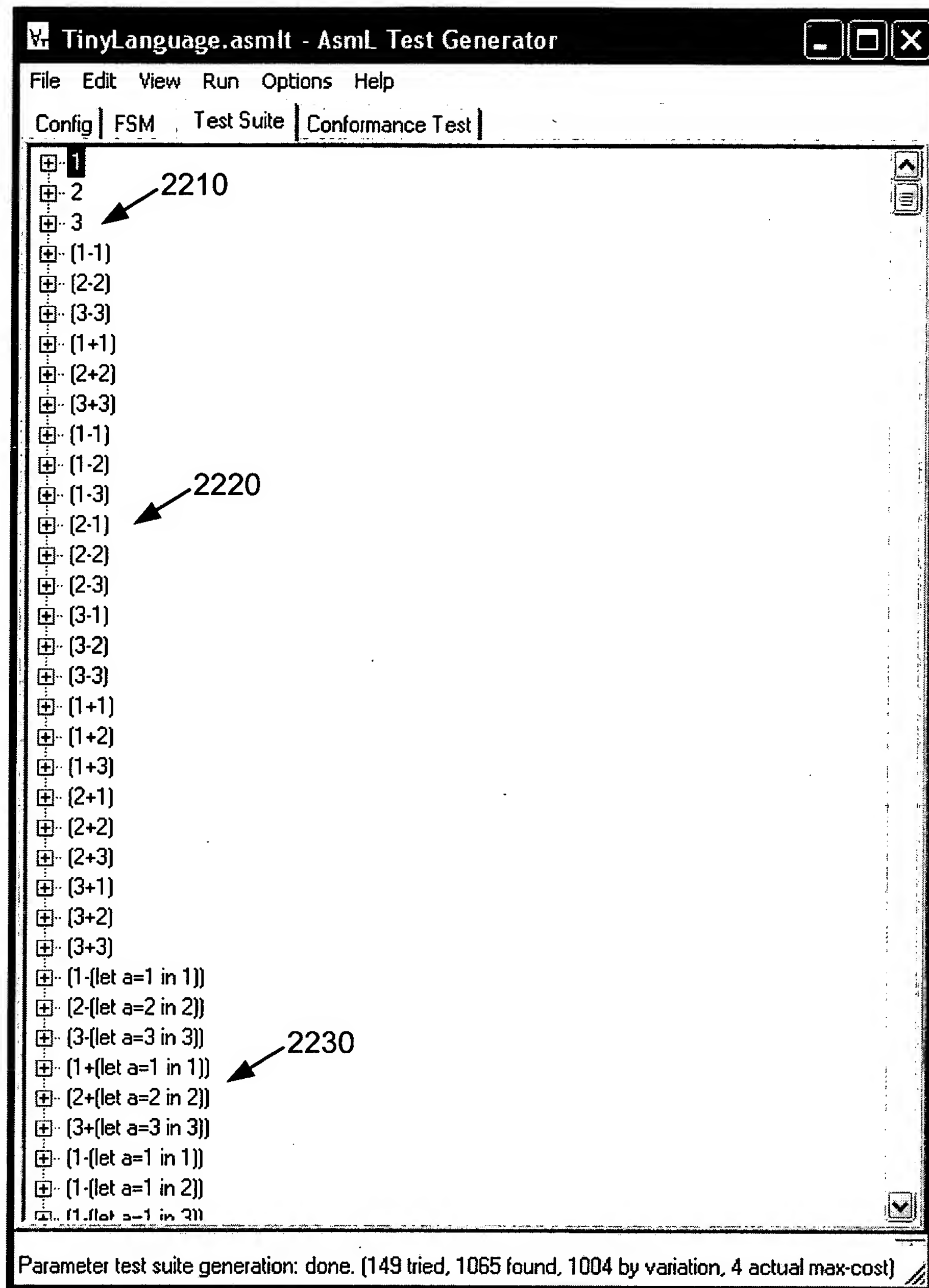


FIG. 23

